



## Small Site Drainage Report

**Project Name:** NE 95<sup>th</sup> St Short Plat

**Project Address:** 13040 NE 95<sup>th</sup> St, Kirkland, Washington 98033

**Parcel Number:** 388810-0177, 388810-0175

**Name of Developer:** DC Granger

**Name of Engineer:** Brett K. Pudists, PE

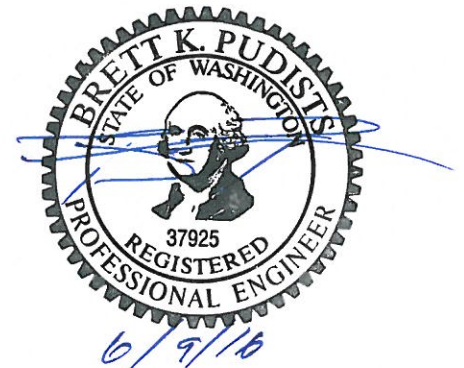
**Company:** The Blueline Group

**Address:** 25 Central Way, Suite 400, Kirkland, Washington

**Phone Number:** (425) 216-4051

**Report Date:** June 9, 2016

**Engineer's Stamp:**



**CITY OF KIRKLAND  
PERMIT NO. LSM16-03107  
APPROVED BY: DAN CARMODY  
DATE: 07/11/2016**

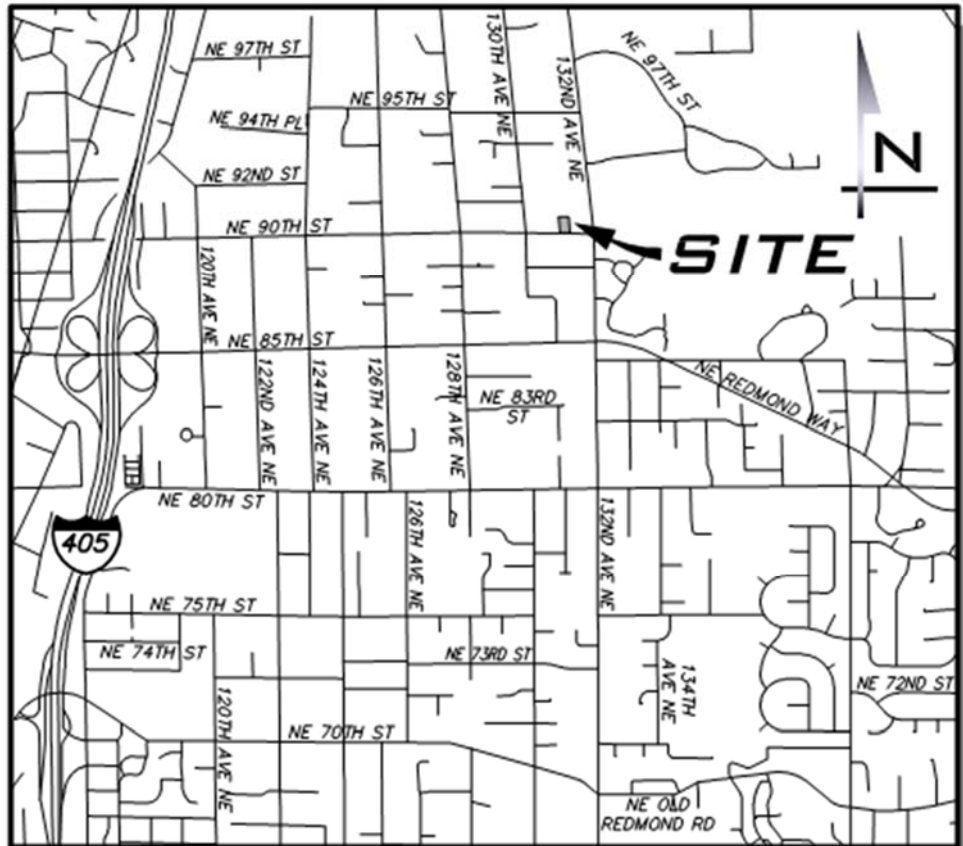
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## Section 1 Project Overview

The project is located at 13040 NE 95 St, Kirkland, WA. More generally, the site is located in NW  $\frac{1}{4}$  of Section 4, Township 25 N, Range 5 E, W.M. Please see the vicinity map below.



Vicinity Map  
Not to Scale

Refer to the *Existing & Developed Conditions Exhibits* included on the following pages. The project consists of two parcels where #388810-0177 is approximately 0.26 acres and #388810-0175 is approximately 0.07 acres. The site contains an existing single-family residence with impervious rooftop and paved/concrete driveway, as well as a mix of pervious lawn, few trees, and residential landscaping. The parcel contains a single drainage basin, and is underlain with Alderwood gravelly sandy loam which typically supports only limited infiltration. A Natural Resource Conservation Service (NRCS) Web Soil Survey is included in Section 3 for reference.

The project will shift lot lines to create two single-family residential lots with supporting infrastructure. The existing residence will be demolished and replaced by two new residences.

Stormwater elements will be designed in accordance with the 2009 King County Surface Water Design Manual (KCSWDM) as adopted and amended by the City of Kirkland.

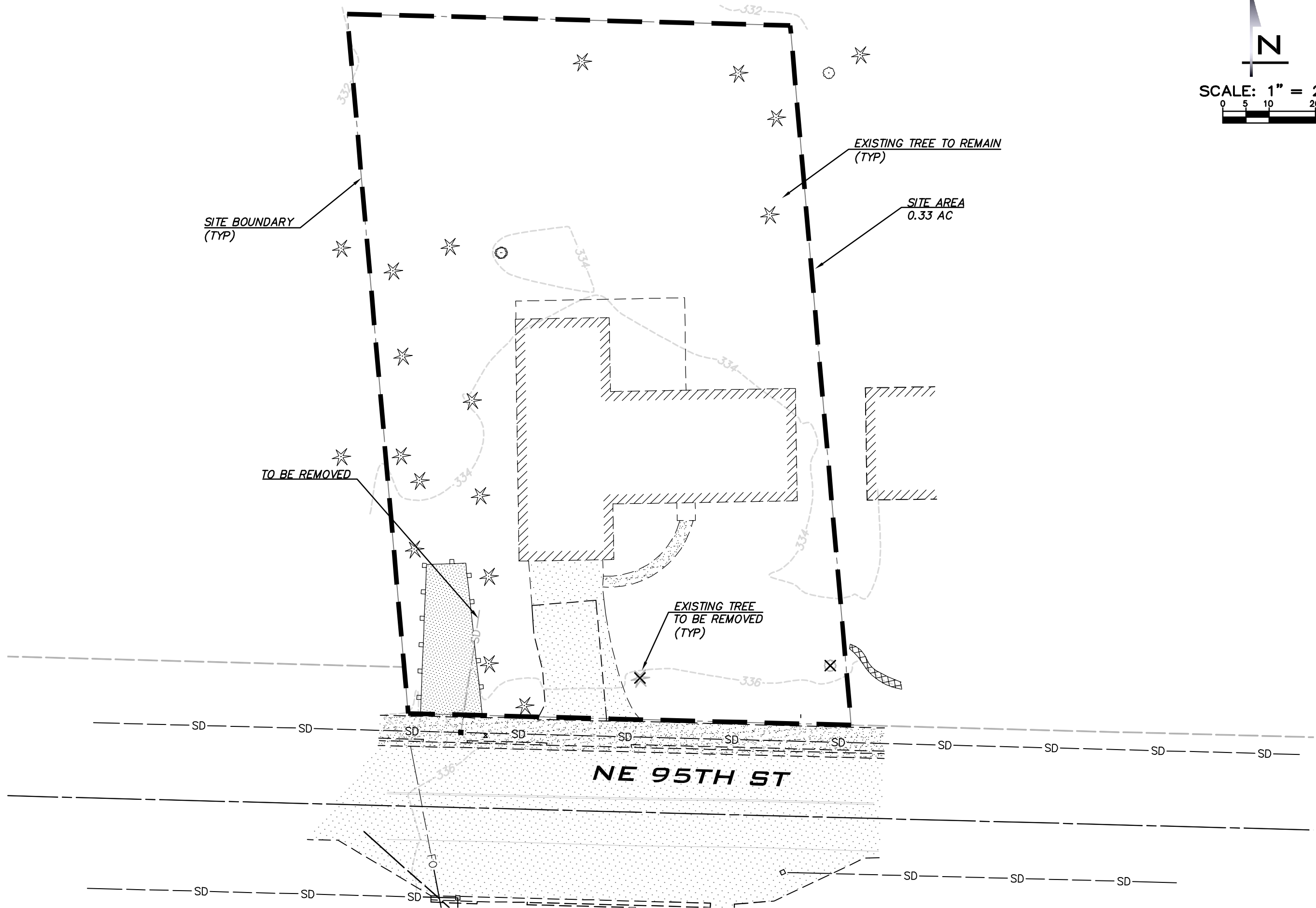
The project proposes no more than 5,000 ft<sup>2</sup> of new impervious area (2,522 ft<sup>2</sup>), and no more than 10,000 ft<sup>2</sup> of a combination of new plus replaced impervious area (6,718 ft<sup>2</sup>). The project is a small two-lot single-family development, and is not part of a larger subdivision. Therefore, Small Site Drainage Review Type II as outlined in City of Kirkland Policy D-2 is applicable. Stormwater Low Impact Development (LID) features will be designed in accordance with Kirkland Policy L-1.

The project proposes less than 5,000 ft<sup>2</sup> of pollution generating impervious surfaces (1,672 ft<sup>2</sup>) and is exempt from providing a water quality treatment facility.

Additional information related to stormwater management elements is provided in later sections of this report.

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# EXISTING CONDITIONS EXHIBIT



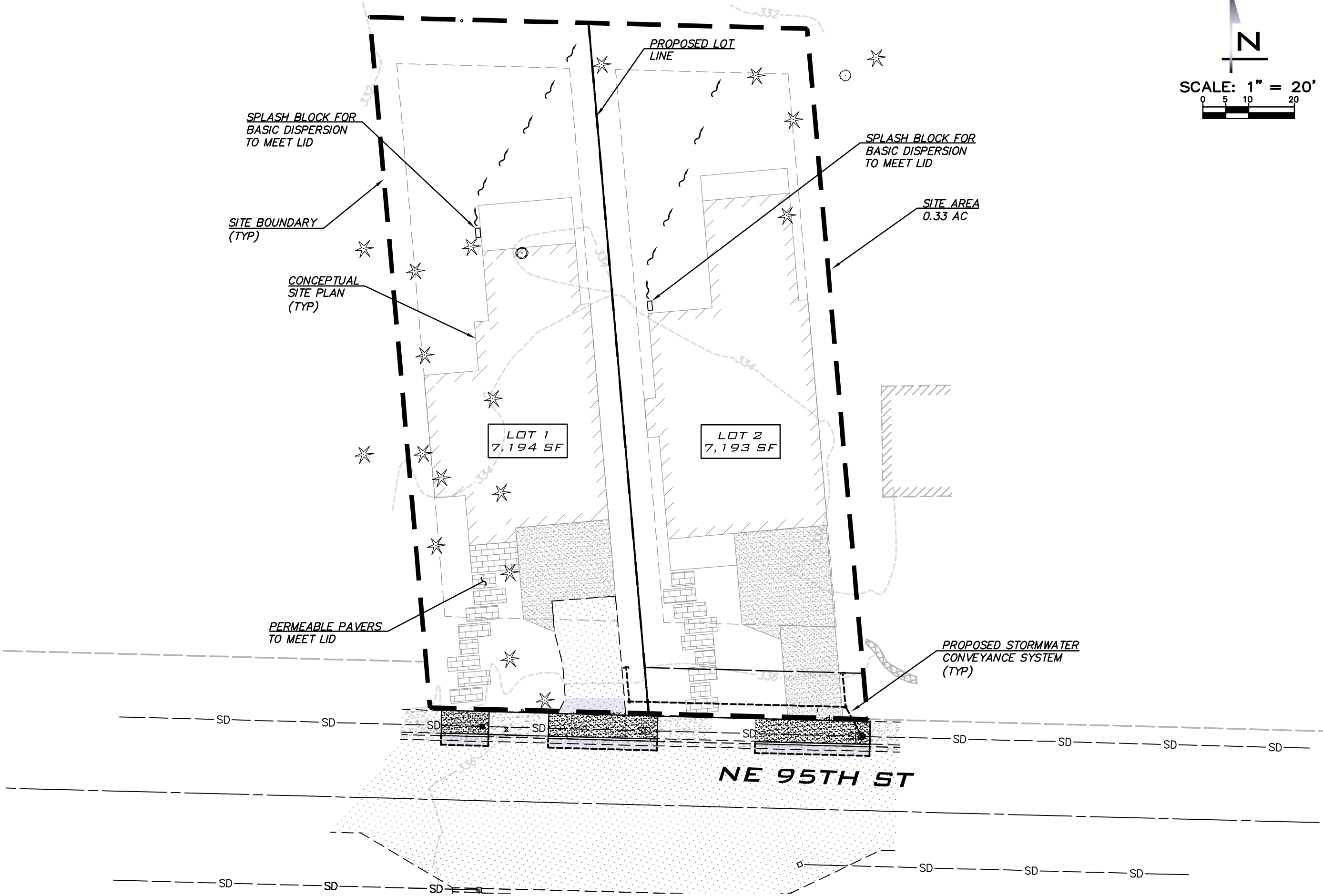
EXISTING CONDITIONS  
NE 95TH ST SHORT PLAT  
SMALL SITE DRAINAGE REPORT  
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SCALE	AS NOTED
PROJECT MANAGER	BRETT PUDISTS, PE
DESIGNED BY	NADIA KROUMOVA
DRAWN BY	LYNDEY MUNKEL, EIT
PLOT DATE	April 21, 2016

JOB NUMBER:  
15-262

FIGURE:  
EC

DEVELOPED CONDITIONS EXHIBIT



DEVELOPED CONDITIONS  
NE 95TH ST SHORT PLAT  
SMALL SITE DRAINAGE REPORT

SCALE	AS NOTED
PROJECT MANAGER	BRETT PUDISTS, PE
DESIGNED BY	NADIA KROUMOVA
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PLOT DATE	April 21, 2016

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15-262

FIGURE:  
DC



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## Section 2 Conditions and Requirements Summary

The project satisfies each Core Requirement of the 2009 KCSWDM as described below.

### **Core Requirement #1: Discharge at the Natural Location**

In the existing conditions, a portion of stormwater runoff flows northeast and is collected by 132<sup>nd</sup> Ave NE. The remaining portion of stormwater runoff sheet flows southwest and goes to a catch basin in NE 95<sup>th</sup> St at the corner of the site and is conveyed east by the public conveyance system in NE 95<sup>th</sup> St. Stormwater from both natural discharge locations combines within a quarter of a mile. The proposed development will discharge to the NE 95<sup>th</sup> St conveyance system and will be conveyed east and north as in the existing conditions. This will maintain the natural discharge location of the site.

### **Core Requirement #2: Off-site Analysis**

See Section 3. A Level 1 Downstream Analysis has been provided.

### **Core Requirement #3: Flow Control**

See Section 4. The project proposes no more than 5,000 ft<sup>2</sup> of new impervious area, and no more than 10,000 ft<sup>2</sup> of a combination of new plus replaced impervious area. The project is a small two-lot single-family development, and is not part of a larger subdivision. Therefore, Small Site Drainage Review Type II as outlined in City of Kirkland Policy D-2 is applicable, requiring only LID BMPs for drainage control.

### **Core Requirement #4: Conveyance System**

See Section 5. The conveyance system is designed to convey the 100-year, 24-hour storm event without overtopping.

### **Core Requirement #5: Erosion and Sediment Control**

See Section 8. The temporary erosion and sedimentation control plan consists of temporary measures such as a rock entrance, inlet protection, silt fence, sediment trap, etc.).

### **Core Requirement #6: Operations and Maintenance**

See Section 10. All drainage lines and structures within the ROW and easements will be maintained by the City of Kirkland. All drainage lines and structures within the lot lines will be the responsibility of the individual lot owners.

**Core Requirement #7: Financial Guarantees and Liability**

See Section 9. A City of Kirkland Improvement Evaluation Packet is included in this report.

**Core Requirement #8: Water Quality**

Please see Section 4. The project will create less than 5,000 ft<sup>2</sup> of new PGIS and is exempt from providing a water quality treatment facility.

Special Requirement #1: Other Adopted Area-Specific Requirements: There are no known additional requirements for the project.

Special Requirement #2: Floodplain/Floodway: The site does not contain and is not adjacent to a flood hazard area.

Special Requirement #3: Flood Protection Facilities: The site does not rely on an existing flood protection facility, and the project will not modify or construct a new flood protection facility.

Special Requirement #4: Source Control: The project is a small residential development that does not require source control.

Special Requirement #5: Oil Control: The project is a small residential development that does not require oil control.

## Section 3      Offsite Analysis

This section contains a Level 1 Downstream Analysis.

### **TASK 1: DEFINE AND MAP THE STUDY AREA**

A *Downstream Drainage Exhibit* and *Downstream Drainage Photographs* are included at the end of this section.

### **TASK 2: RESOURCE REVIEW**

The best available resource information, including King County iMAP and City of Kirkland resource maps, were reviewed for existing or potential problems. The following is a summary of the findings from the information used in preparing this report.

- According to the USDA soil survey, the onsite soils consist of Alderwood Gravelly Sandy Loam (8-15 percent slopes).
- The site contains a single drainage basin.
- The site does not contain wetlands (City of Kirkland).
- The site does not contain streams and is not located within a floodplain (City of Kirkland).
- The site is not located in an Erosion Hazard Area (King County iMap).
- The site is not located in a High Landslide Hazard Area (City of Kirkland).
- The site is not located in a Seismic Hazard Area (City of Kirkland).
- The site and its downstream path have no drainage complaints on record or in adjacent parcels.

### **TASK 3 AND TASK 4: FIELD INSPECTION AND DRAINAGE SYSTEM DESCRIPTION**

A field inspection was conducted on Thursday, January 14, 2016, a sunny day with temperatures around 45°F. Please reference the *Downstream Drainage Exhibit* and *Downstream Drainage Photographs* included at the end of this section.

#### **Onsite Basin**

The site contains an existing single-family residence with an asphalt driveway surrounded by lawn. The USDA NRCS Web Soil Survey, included at the end of this section, indicates onsite soils consist of Alderwood gravelly sandy loam, 8% to 15% slopes. The project site consists of one drainage basin with two general discharge locations. Flows from the two discharge locations converge within ¼ mile downstream of the site. The two drainage paths are described below. See *Existing Conditions Exhibit* in *Section 1* of this report.

#### **Upstream Basin**

Based on City of Kirkland GIS, there is no contributing upstream basin.

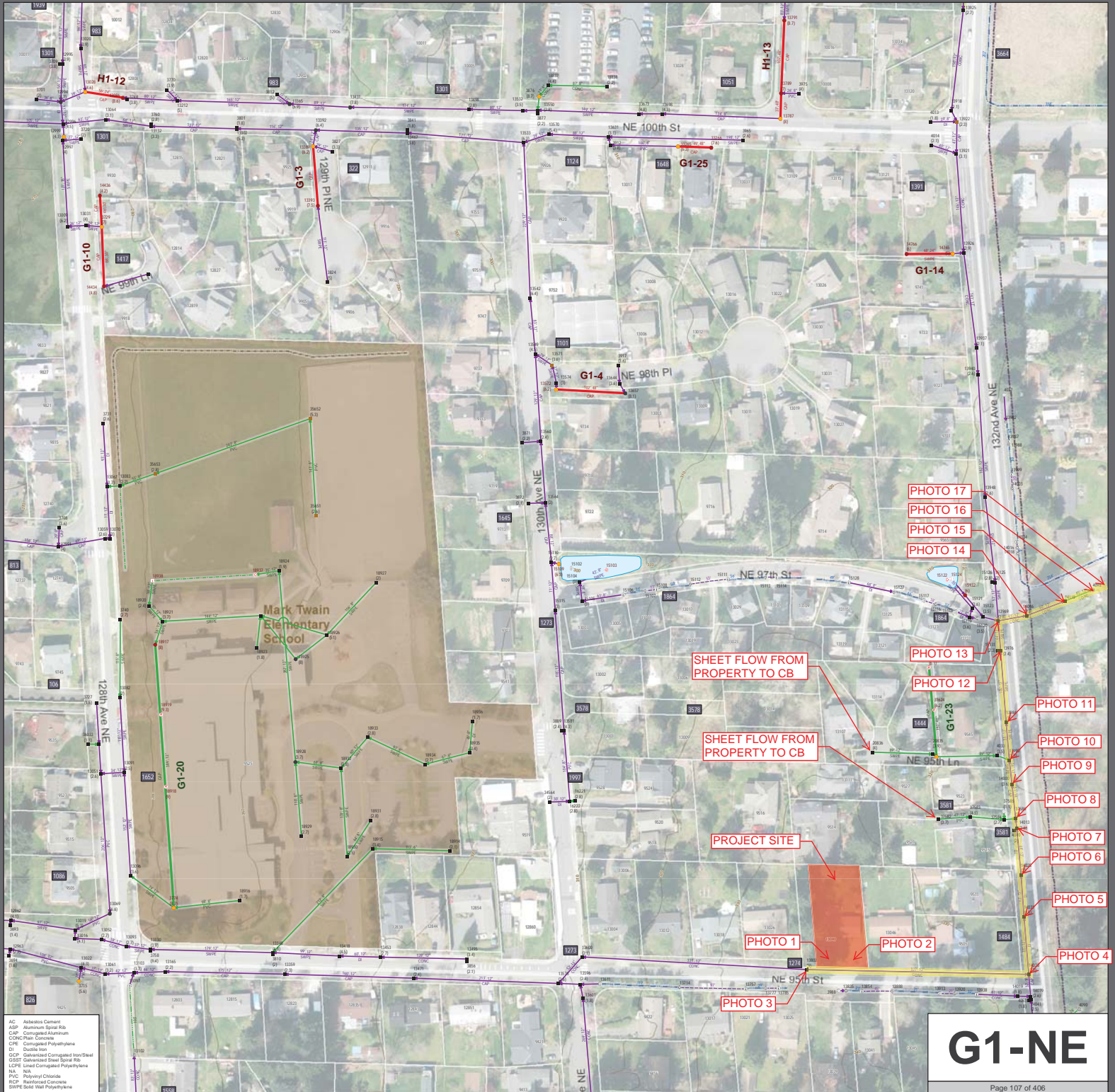
#### **Existing Downstream Drainage Path**

Runoff leaves the site in one of two ways – via sheet flow northeast across the property or via storm drain pipe in the southwest corner of the property.

Flows from the northern portion of the site sheet flow northeast across the property. Based on City of Kirkland GIS contours and aerial, it appears that runoff continues northeast and is most likely collected in catch basins either on the private access driveway for parcel #388810-0216 and #388810-0217 or on NE 95<sup>th</sup> Lane. Both storm systems combine with the tight-lined conveyance system described below within ¼ mile.

Flows collected in the 12" concrete storm drain pipe at the southwest corner are conveyed approximately 27 feet southwest to a catch basin on NE 95<sup>th</sup> Street (Photo 3). Flows are conveyed approximately 327 feet east through 12" concrete pipe to a catch basin at the northwest corner of NE 95<sup>th</sup> Street and 132<sup>nd</sup> Avenue NE (Photo 4). Flows are conveyed approximately 85 feet north through 12" ductile iron pipe to a catch basin on 132<sup>nd</sup> Avenue NE (Photo 5). Flows are conveyed approximately 62 feet north through 12" ductile iron pipe to a catch basin on 132<sup>nd</sup> Avenue NE (Photo 6). Flows are conveyed approximately 69 feet north through 12" ductile iron pipe to a catch basin on 132<sup>nd</sup> Avenue NE (Photo 7). Flows are conveyed approximately 15 feet north through 12" ductile iron pipe to a catch basin on 132<sup>nd</sup> Avenue NE (Photo 8). Based on City of Kirkland GIS contours and aerial, this is one of the two locations where sheet flow from the site combines with the tight-lined conveyance system.

Flows are conveyed approximately 51 feet north through 12" corrugated aluminum pipe to a catch basin on 132<sup>nd</sup> Avenue NE (Photo 9). Flows are conveyed approximately 36 feet north through 12" solid wall polyethylene pipe to a catch basin on 132<sup>nd</sup> Avenue NE (Photo 10). Based on City of Kirkland GIS contours and aerial, this is one of the two locations where sheet flow from the site combines with the tight-lined conveyance system. Flows are conveyed approximately 55 feet north through 12" solid wall polyethylene pipe to a catch basin on 132<sup>nd</sup> Avenue NE (Photo 11). Flows are conveyed approximately 106 feet north through 12" solid wall polyethylene pipe to a catch basin on 132<sup>nd</sup> Avenue NE (Photo 12). Flows are conveyed approximately 44 feet north through 12" solid wall polyethylene pipe to a catch basin on 132<sup>nd</sup> Avenue NE (Photo 13). Flows are conveyed approximately 43 feet east through 12" concrete pipe to a catch basin at the southeast corner of 132<sup>nd</sup> Avenue NE and NE 97<sup>th</sup> Street (Photo 14). Flows are conveyed approximately 60 feet northeast through 12" concrete pipe to a catch basin on NE 97<sup>th</sup> Street (Photo 15). Flows are conveyed approximately 45 feet northeast through 12" concrete pipe to a ditch along NE 97<sup>th</sup> Street (Photo 16). This ditch crosses under a fence onto parcel #032505-9039 (Photo 17). Based on City of Redmond stormwater system maps, the drainage is eventually tributary to the Sammamish River.



**Downstream Drainage Photographs**

**Note:** See the *Downstream Drainage Exhibit* for numbered locations of pictures.



Photo 1: Flows in the southern portion of the site – shown here – are collected in a storm drain pipe in the southwest corner of the property – looking north.



Photo 2: Flows in the southern portion of the site – shown here – are collected in a storm drain pipe in the southwest corner of the property – looking north.



Photo 3: Catch basin with 12" pipe conveys flows to the east – looking east.



Photo 4: Catch basin with 12" pipe conveys flows to the north – looking north.



Photo 5: Catch basin with 12" pipe conveys flows to the north – looking north.



Photo 6: Catch basin with 12" pipe conveys flows to the north – looking north.



Photo 7: Catch basin with 12" pipe conveys flows to the north – looking north.



Photo 8: Catch basin (right) with 12" pipe conveys flows to the north – looking north.



Photo 9: Catch basin with 12" pipe conveys flows to the north – looking north.



Photo 10: Catch basin with 12" pipe conveys flows to the north – looking north.



Photo 11: Catch basin with 12" pipe conveys flows to the north – looking north.



Photo 12: Catch basin with 12" pipe conveys flows to the northeast – looking northeast.



Photo 13: Catch basin with 12" pipe conveys flows to the northeast – looking northeast.



Photo 14: Catch basin with 12" pipe conveys flows to the northeast – looking northeast.



Photo 15: Catch basin with 12" pipe conveys flows to the northeast – looking northeast.



Photo 16: The tight-lined conveyance outfalls to a ditch along NE 97<sup>th</sup> Street.




Photo 17: This ditch crosses under a fence onto parcel #032505-9039.

# Soil Map—King County Area, Washington (15-262 WSS )



## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### Water Features



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

### Background



Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: King County Area, Washington  
Survey Area Data: Version 11, Sep 14, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 31, 2013—Oct 6, 2013

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

King County Area, Washington (WA633)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AgC	Alderwood gravelly sandy loam, 8 to 15 percent slopes	0.3	100.0%
Totals for Area of Interest		0.3	100.0%

## Section 4 Flow Control/Water Quality Analysis and Design

The project proposes no more than 5,000 ft<sup>2</sup> of new impervious area (2,522 ft<sup>2</sup>), and no more than 10,000 ft<sup>2</sup> of a combination of new plus replaced impervious area (6,718 ft<sup>2</sup>). Small Site Drainage Review Type II as outlined in City of Kirkland Policy D-2 is applicable.

### 4.1 LID BMPs

COK Policy L-1, included on the following pages, states that the feasibility and applicability for LID stormwater options must be evaluated for projects meeting the threshold for Small Site Drainage Review Type II. LID BMPs have been assessed and are proposed to the maximum extent feasible.

Per Policy L-1, for lots less than 11,000 ft<sup>2</sup>, runoff must be routed from an impervious surface area equal to at least 10% of the lot to one or more storm LID BMPs. LID requirements are satisfied through the use of basic dispersion and permeable pavement as outlined below. Please see below for required impervious surface areas.

Lot #1 @ 7,194 ft<sup>2</sup> = 719 ft<sup>2</sup> required (10%)  
700 ft<sup>2</sup> basic dispersion using splash blocks  
19 ft<sup>2</sup> minimum permeable pavement (pedestrian)

Lot #2 @ 7,193 ft<sup>2</sup> = 719 ft<sup>2</sup> required (10%)  
700 ft<sup>2</sup> basic dispersion using splash blocks  
19 ft<sup>2</sup> minimum permeable pavement (pedestrian)

Per Section C.2.4.2 of the 2009 KCSWDM, no more than 700 ft<sup>2</sup> of roof area may be drained to a single splash block and a vegetated flowpath segment of at least 50 feet in length must be available along the flowpath that runoff would follow upon discharge from the splash block. These design specifications are accommodated.

## CITY OF KIRKLAND

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### DEPARTMENT OF PUBLIC WORKS PRE-APPROVED PLANS POLICY

#### **Policy L-1: FEASIBILITY OF STORMWATER LOW IMPACT DEVELOPMENT (LID) FOR SMALL PROJECT TYPE I<sup>1</sup>, TYPE II<sup>2</sup> & TARGETED<sup>3</sup> PROJECTS**

The City of Kirkland encourages (and sometimes requires) the use of stormwater low impact development (LID) on all projects, whenever feasible. The intent of stormwater LID techniques is to mimic natural hydrologic processes (allow runoff to infiltrate into the ground), and to mitigate for impervious surfaces added through development.

Stormwater LID is **encouraged for TYPE I** projects, but is not required.

Applicants for projects meeting the threshold for Small Project **Type II** and **Targeted** Drainage Review must evaluate the feasibility of dispersion, infiltration, and/or other Stormwater LID options.

#### **EVALUATION**

##### **Evaluate the feasibility of Dispersion BMPs:**

- **Full Dispersion** is feasible if the proposed project has 50-100 feet of native vegetated flowpath (depending on the dispersion method) to disperse the runoff from the new and/or replaced impervious surface area. A SW Adjustment form (Policy D-11) may be necessary if less than 100ft flowpath, with approval on a case-by-case basis.
- **Basic Dispersion** is feasible if the project has 25-50 feet of vegetated flowpath (does not have to be native vegetation) to disperse the runoff. Other constraints affecting feasibility are steep slopes (greater than 15%), sensitive areas, and the potential to cause or aggravate flooding and erosion problems to adjacent properties. If dispersion is feasible, use the design criteria for dispersion BMPs in Appendix C of the 2009 King County Surface Water Design Manual (KCSWDM).

If Dispersion BMPs are not feasible, **evaluate the feasibility of Infiltration BMPs**. Potential constraints to consider are soil type, ground water level, and steep slopes (15% or greater). If possible, design infiltration facilities with an overflow connection to the public storm drainage system.

If the BMPs involving dispersion or infiltration are not feasible, then **consider the other LID BMPs** (rainwater harvesting, vegetated roof, reduced impervious surface credit, and native growth retention credit) for the project.

#### **BMP AREA REQUIREMENTS**

The amount of impervious area routed to storm LID BMPs varies based on the size of the lot:

1. For a lot up to 11,000sf, route runoff from an impervious surface area equal to at least **10% of the lot** to one or more storm LID BMPs.
2. For a lot between 11,000 and 22,000sf, route runoff from an impervious surface area equal to at least **20% of the lot** to one or more storm LID BMPs. If total impervious area is less than 20% of the site, route all impervious area to one or more LID BMPs.
3. For a lot greater than 22,000sf, **all new and replaced impervious area** must be routed to one or more storm LID BMPs.

<sup>1</sup>Type I project refers to small projects creating between 500 and 1,999ft<sup>2</sup> new impervious (see Policy D-2 for full definition).

<sup>2</sup>Type II project refers to small projects creating between 2,000 and 5,000ft<sup>2</sup> new impervious (see Policy D-2 for full definition).

<sup>3</sup>Targeted project refers to small projects creating between 2,000 and 5,000ft<sup>2</sup> new impervious, but also contains sensitive areas or other issues triggering more review than Type II (see Policy D-3 for full definition).

### **SOIL REPORT**

A small site **Soil Report is required** for infiltration trenches, drywells, rain gardens, and pervious pavement **without an overflow connection** to the public storm drainage system.

A small site Soil Report includes the following (2009 KCSWDM, page C-41):

1. At least one soil log for each proposed infiltration location, including:
  - a. a minimum of 4 feet deep (6 feet if drywell is proposed), and
  - b. a soil description from each horizon through the depth of the log, and
  - c. notes of any evidence of a high groundwater table, such as mottling.
2. Level of maximum wet-season water table (minimum of 1 foot between bottom of gravel filled facility and maximum wet season water table).
3. Soil report must be prepared by or under the direction of a licensed civil engineer, engineering geologist, geotechnical engineer, or onsite sewage system designer.
4. If soils are coarse sands or cobbles or medium sands, then an infiltration rate is not required and facility can be sized based on small site requirements in Appendix C (2009 KCSWDM). If soils are other type then an infiltration rate is required and the facility must be designed to fully infiltrate.

If an **overflow connection can be installed**, then a **soil report is not required** for basic infiltration with the following BMPs:

1. 30 foot long infiltration trench for 1,000sf of area,
2. 90 cubic feet of drywell for 1,000sf of area,
3. Rain garden per design criteria in Appendix C of 2009 KCSWDM, and
4. Permeable pavement per design criteria in Appendix C of the 2009 KCSWDM.

### **LID BMP OPTIONS**


All stormwater LID BMPs must be designed and installed according to the 2009 KCSWDM, COK Addendum, and the Public Works Pre-Approved Plans. Listed below are the Stormwater LID options from the 2009 KCSWDM:

1. Dispersion (Appendix C, section C.2.4)
2. Infiltration (Appendix C, section C.2.3)
3. Rain Garden (Appendix C, section C.2.5)
4. Permeable Pavement (Appendix C, section C.2.6)
5. Rainwater Harvesting (Appendix C, section C.2.7)
6. Vegetated Roof (Appendix C, section C.2.8)
7. Reduced Impervious Surface Credit (Appendix C, section C.2.9)
8. Native Growth Retention Credit (Appendix C, section C.2.10)

### **ADDITIONAL INFORMATION**

**Applicant must submit a Feasibility Summary of their analysis used to determine the BMPs proposed to meet the requirements stated above. Include a soil report if required.**

As the design professional of record for this project (Civil, Geotechnical Engineer, or Architect), the following choice of LID application and storm conveyance is noted on the attached summary sheet.

By:  Title: Project Manager BLG Date: 4/21/16

City policy is to require the installation of stormwater LID to the maximum extent feasible. The City acknowledges stormwater LID may not work on some sites, due to topography, soil, or other site specific conditions. Policy D-11 contains a Stormwater Adjustment Form that must be completed if standard storm LID BMPs are not feasible at a site. If standard LID options are not feasible, at a minimum amended soil will be required in all landscaped areas and/or additional landscape/trees as appropriate.

## 4.2 WATER QUALITY ANALYSIS AND DESIGN

Per Section 1.2.8.2 of the City of Kirkland 2016 Pre-Approved Plans, water quality treatment is required if the overall project creates or replaces 5,000 ft<sup>2</sup> or more of pollution generating impervious surface (PGIS) area. The project proposes less than 5,000 ft<sup>2</sup> (1,672 ft<sup>2</sup>) of PGIS and is exempt from providing a water quality treatment facility.

## Section 5 Conveyance Design

Roof and footings drains for each residence will be connected to the onsite gravity system. The proposed onsite gravity service connection consists of 6-inch diameter storm pipe which will connect to an existing type II catch basin within the public right-of-way of NE 95<sup>th</sup> Street.

### Pipe Sizing:

The 6-inch conveyance pipe is sized to convey the maximum allowed coverage for the site, 50%, per City of Kirkland zoning code totaling 7,194 ft<sup>2</sup>.

Per Section II.B.1 of Storm Drainage – Design Criteria from the City of Kirkland 2016 Pre-Approved Plans, the size of the required pipe will be based on the Manning Equation with a minimum slope of 0.02 ft./ft. for 6-inch pipe. Based on anticipated elevations, 6-inch pipe installed onsite at minimum 1% slope is proposed. This pipe has the capacity to convey onsite flows and meets the required minimum velocity at full flow, 3.00 fps. See calculations on the following page.

Using Manning's equation, the 6-inch pipe installed onsite at minimum 1% slope has capacity to convey 0.607 cfs. By comparison, the 100-year flow calculated using the rational method is 0.575 cfs for the 0.33 acres of property.

Calculations using *Manning's Equation*, the equation for volumetric flowrate, and the *Rational Method* are included on the following page and reflect the areas in the table below.

<b>Property Area</b>			
Lot 1 Total Area	7,194 sf	0.165	ac
Impervious	3,597 sf	0.083	ac
Pervious	3,597 sf	0.082	ac
Lot 2 Total Area	7,193 sf	0.165	ac
Impervious	3,597 sf	0.083	ac
Pervious	3,596 sf	0.082	ac

**MANNING'S EQUATION; 6" Pipe @ 1% = 0.607 cfs**

$$Q = 1.486/n * A * R^{2/3} * S^{1/2}$$

$$n = \text{roughness coefficient} = \mathbf{0.012}$$

$$A = \text{cross sectional area of pipe} = \pi (D/2)^2 = \pi (0.5 \text{ ft}/2)^2 = \mathbf{0.196}$$

$$R = \text{wetted perimeter of pipe}$$

$$R^{2/3} = (D/4)^{2/3} = (0.5/4)^{2/3} = \mathbf{0.25}$$

$$S = \text{slope}$$

$$S^{1/2} = (0.01 \text{ ft/ft})^{1/2} = \mathbf{0.10}$$

$$Q = (1.486/0.012) * 0.196 * 0.25 * 0.10 = \mathbf{0.607 \text{ cfs}}$$

$$Q = V * A$$

$$V = Q/A$$

$$Q = (1.486/0.012) * 0.196 * 0.25 * 0.10 = \mathbf{0.607 \text{ cfs}}$$

$$A = \text{cross sectional area of pipe} = \pi (D/2)^2 = \pi (0.5 \text{ ft}/2)^2 = \mathbf{0.196}$$

$$0.607 / 0.196 = \mathbf{3.10 \text{ fps} > 3.00 \text{ fps OK}}$$

**RATIONAL METHOD: Property Area**

$$Q = CIA \text{ (cfs)}$$

C = Runoff Coefficient (weighted average)

C = 0.90 for driveways and roofs

C = 0.25 for lawns

*Weighted C Determination*

$$C = (0.90 (0.165 \text{ ac}) + 0.25 (0.165 \text{ ac})) / 0.33 \text{ ac} = \mathbf{0.575}$$

$$I_R = \text{Peak Rainfall Intensity} = P_R I_R = \mathbf{3.029}$$

$$P_R = \mathbf{3.7 \text{ inches}} \text{ (100-year, 24-hour runoff)}$$

$$I_R = a_R T_c^{-b_R} =$$

$$a_R = 2.61 \text{ (100-year)}$$

$$b_R = 0.63 \text{ (100-year)}$$

$$T_c = \text{Time of concentration} \text{ (6.3 minutes minimum)}$$

A = Area in Acres

Rational Method; Site-area flows:

$$Q_R = C I_R A = (0.575) (3.029) (0.33 \text{ ac}) = \mathbf{0.575 \text{ cfs}}$$

## Section 6    Special Reports and Studies

There are no additional special reports and studies associated with this project at this time.

## Section 7    Other Permits

No other permits related to the site storm drainage are required at this time.

## Section 8 TESC Analysis and Design

The temporary erosion and sedimentation control plan is designed to reduce the discharge of sediment-laden runoff from the site. The plan is comprised of temporary measures (rock entrance, filter fence, straw mulch, etc.) as well as permanent measures (hydroseeding and landscaping).

The following BMPs will be applied to prevent erosion and trap sediments within the project site and are shown on sheet TP-01:

- **Mark Clearing Limits / Minimize Clearing** – Prior to any site clearing or grading, the clearing limits as noted on sheet TP-01 are to be marked in the field. The trees to remain will have tree protection measures installed per City of Kirkland detail on sheet TD-01.
- **Minimize Sediment Tracked Offsite** – A stabilized construction entrance shall be installed as the first step in clearing and grading. The construction entrance is to be installed per City of Kirkland Standard Plan No. CK-E.01 at the location shown on sheet TP-01.
- **Control Sediment** – Perimeter protection to filter sediment from sheetwash shall be located downslope of all disturbed areas and shall be installed prior to upslope grading. The silt fence will be installed along the boundary of the site to retain all sediment on site, as shown on sheet TP-01. Additionally, storm drain inlet protection measures will be applied to all catch basins within the project vicinity. See sheet TP-01 for more details.
- **Stabilize Exposed Soils** – Temporary and permanent cover measures shall be provided to protect all disturbed areas. Cover measures include the use of surface roughening, mulch, erosion control nets and blankets, plastic covering, seeding, and sodding. See sheet TD-01 for more details.
- **Control Runoff**– All drainage will remain in a sheet flow condition during construction. This requirement is, therefore, not applicable.
- **Control Dewatering**– Any runoff generated by dewatering shall be treated by releasing the water to a well vegetated, gently sloping area. See notes on sheet TD-01.

- **Control Other Pollutants** – Pollutants shall be controlled per TESC notes shown on sheet TD-01.
- **Final Stabilization** – Prior to final construction approval, the project site shall be stabilized to prevent sediment-laden water from leaving the site after project completion. All disturbed areas shall be vegetated or otherwise permanently stabilized. See sheet TD-01 for more detail.

## **Section 9      Bond Quantities and Facilities Summary**

A City of Kirkland Improvement Evaluation Worksheet is provided on the following pages in this section.

## Public Improvements

### Construction Storm Drainage

Item	Unit	Quantity	Unit Price	Amount
Silt Fence, Installed	LF	170	\$5.00	\$850.00
Grading for Drainage Swales	LF		\$4.00	\$0.00
Sod for Drainage Swales	SY		\$9.00	\$0.00
Hydroseeding	SY		\$1.00	\$0.00
Construction Entrance (SF)	EA	1	\$3,200.00	\$3,200.00
Construction Entrance (MF/COM/Other)	EA		\$6,400.00	\$0.00
Inlet Protection	EA	2	\$74.00	\$148.00
Straw Wattle	LF		\$4.00	\$0.00
Orange Construction Fencing	LF	275	\$3.00	\$825.00
Check Dam	EA		\$19.00	\$0.00
				\$0.00
				\$0.00

Construction Storm Drainage - Total	\$5,023.00
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### Clearing and Grading

Item	Unit	Quantity	Unit Price	Amount
Half-Street Improvements	LF		\$47.50	\$0.00
Full-Street Improvements	LF		\$95.00	\$0.00
				\$0.00
				\$0.00

Clearing and Grading - Total	\$0.00
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## Water System

Item	Unit	Quantity	Unit Price	Amount
Water Service - 3/4" to 1"	LS	2	\$2,050.00	\$4,100.00
Water Service - 1 1/2" to 2"	LS		\$4,725.00	\$0.00
4" Pipe	LF		\$65.00	\$0.00
6" Pipe	LF		\$97.00	\$0.00
8" Pipe	LF		\$124.00	\$0.00
12" Pipe	LF		\$158.00	\$0.00
2" Gate Valve	EA		\$300.00	\$0.00
4" Gate Valve	EA		\$600.00	\$0.00
6" Gate Valve	EA		\$1,500.00	\$0.00
8" Gate Valve	EA		\$1,600.00	\$0.00
12" Gate Valve	EA		\$2,300.00	\$0.00
Connection to Ex. Main	EA		\$4,800.00	\$0.00
Fire Hydrant Assembly	EA		\$6,540.00	\$0.00
2" Blow Off	EA		\$2,200.00	\$0.00
Air and Vacuum Assembly	EA		\$4,450.00	\$0.00
Valve Marker Post	EA		\$200.00	\$0.00
5" Storz Coupling	EA		\$500.00	\$0.00
Adjust Ex. Water Meter	EA		\$600.00	\$0.00
				\$0.00
				\$0.00

Water System - Total	\$4,100.00
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## Sanitary Sewer System

Item	Unit	Quantity	Unit Price	Amount
6" PVC Pipe	LF	60	\$100.00	\$6,000.00
8" PVC Pipe	LF		\$120.00	\$0.00
12" PVC Pipe	LF		\$150.00	\$0.00
Extra Depth Excavation (Over 12' Deep)	FT*LF		\$8.00	\$0.00
48" Manhole	EA		\$3,600.00	\$0.00
54" Manhole (Drop MHs Only)	EA		\$4,000.00	\$0.00
Internal Drop Structure	EA		\$970.00	\$0.00
Rechannel Existing MH	EA		\$2,660.00	\$0.00
Cast Iron Clean Out Cover	EA		\$160.00	\$0.00
Clean Out Assembly	EA	3	\$735.00	\$2,205.00
				\$0.00
				\$0.00

Sanitary Sewer System - Total	\$8,205.00
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## Storm Drainage System

Item	Unit	Quantity	Unit Price	Amount
8" Pipe	LF		\$65.00	\$0.00
12" Pipe	LF		\$70.00	\$0.00
18" Pipe	LF		\$80.00	\$0.00
24" Pipe	LF		\$100.00	\$0.00
30" Pipe	LF		\$120.00	\$0.00
36" Pipe	LF		\$133.00	\$0.00
48" Pipe	LF		\$145.00	\$0.00
Extra Depth Excavation (Over 12' Deep)	FT*LF		\$6.00	\$0.00
Detention Vault	CF		\$10.00	\$0.00
Other Flow Control Facility	LS			\$0.00
Curb Inlet	EA		\$1,500.00	\$0.00
Type I Catch Basin	EA		\$1,100.00	\$0.00
Type IL Catch Basin	EA		\$1,500.00	\$0.00
Type II Catch Basin - 48"	EA	1	\$3,300.00	\$3,300.00
Type II Catch Basin - 54"	EA		\$4,700.00	\$0.00
CMP Access to Riser	EA		\$1,600.00	\$0.00
Connection to Existing CB	EA		\$940.00	\$0.00
Restrictor/Pollution Control - 8"	EA		\$900.00	\$0.00
Restrictor/Pollution Control - 12"	EA		\$900.00	\$0.00
Pollution Control Tee	EA		\$500.00	\$0.00
Debris Barrier	EA		\$1,400.00	\$0.00
Biofiltration Swale	LF		\$15.00	\$0.00
				\$0.00
				\$0.00

Storm Drainage System - Total	\$3,300.00
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## Low Impact Development

Item	Unit	Quantity	Unit Price	Amount
Pervious Concrete	LF		\$108.00	\$0.00
Pervious Asphalt	LF		\$44.00	\$0.00
Pervious Pavers	SY		\$120.00	\$0.00
Infiltration/Dispersion Trench (10')	EA		\$300.00	\$0.00
Rain Garden	SY		\$120.00	\$0.00
Soil Amendment	SY		\$1.50	\$0.00
Drywell Infiltration	EA		\$500.00	\$0.00
				\$0.00
				\$0.00

Low Impact Development	\$0.00
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## Paving

Item	Unit	Quantity	Unit Price	Amount
AC Pavement Patching	SY		\$21.00	\$0.00
4" Crushed Rock	SY	30	\$12.00	\$360.00
Bank Run Gravel: 3" minus, in place	CY		\$68.00	\$0.00
4" Asphalt Treated Base (ATB)	SY	15	\$21.00	\$315.00
2" Class B Asphalt Pavement	SY	30	\$19.00	\$570.00
Saw Cut AC Pavement	LF	60	\$3.50	\$210.00
Cold Planing (Grinding) & Hauling	SY		\$13.00	\$0.00
Adjust Existing Utility	EA		\$525.00	\$0.00
				\$0.00
				\$0.00

Paving - Total	\$1,455.00
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## Curb and Gutter

Item	Unit	Quantity	Unit Price	Amount
Concrete Extruded Curb	LF		\$16.00	\$0.00
Asphalt Extruded Curb	LF		\$8.00	\$0.00
Concrete Curb and Gutter, Type A	LF	60	\$42.00	\$2,520.00
Rolled Concrete Curb and Gutter	LF		\$28.00	\$0.00
				\$0.00
				\$0.00

Curb and Gutter - Total	\$2,520.00
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## Sidewalks

Item	Unit	Quantity	Unit Price	Amount
5' Concrete Sidewalk	LF	35	\$44.00	\$1,540.00
Concrete Sidewalk (other than 5')	SF		\$6.00	\$0.00
5' Concrete Driveway	LF	25	\$36.00	\$900.00
Asphalt Walkways, Class B	SY		\$49.00	\$0.00
Wheel Chair Ramps	EA		\$2,060.00	\$0.00
Safety Railing	LF		\$130.00	\$0.00
Steel Pipe Handrail	LF		\$61.00	\$0.00
Vinyl Fencing	LF		\$19.00	\$0.00
Speed Hump Restoration	EA		\$1,500.00	\$0.00
5' Pervious Sidewalk	LF		\$212.00	\$0.00
				\$0.00
				\$0.00

Sidewalks - Total	\$2,440.00
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## Landscaping

Item	Unit	Quantity	Unit Price	Amount
Street Trees	EA		\$355.00	\$0.00
Sod	SY		\$45.00	\$0.00
Seeded lawn	SY		\$5.00	\$0.00
Rockery Wall	SY		\$400.00	\$0.00
				\$0.00
				\$0.00

Landscaping - Total	\$0.00
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## Miscellaneous

Item	Unit	Quantity	Unit Price	Amount
Monuments	EA		\$875.00	\$0.00
Street Signs	EA		\$220.00	\$0.00
Pavement Marking	LF		\$1.30	\$0.00
Mailbox Structure	EA		\$540.00	\$0.00
Type III Fixed Barricade	EA		\$400.00	\$0.00
Bollards	EA		\$840.00	\$0.00
Removable Bollards	EA		\$340.00	\$0.00
Thermoplastic Crosswalk Markings (\$500 min)	LF		\$7.00	\$0.00
Street Light	EA		\$4,000.00	\$0.00
PED Light	EA		\$5,000.00	\$0.00
Modular Block Walls			\$32.00	\$0.00
				\$0.00
				\$0.00

Miscellaneous - Total	\$0.00
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## Other Agency Improvements

Item	Unit	Quantity	Unit Price	Amount
Northshore Utility District	LS			\$0.00
Woodinville Water District	LS			\$0.00
Puget Sound Energy	LS			\$0.00
				\$0.00
				\$0.00

Miscellaneous - Total	\$0.00
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## Private Improvements

### Storm Drainage System

Item	Unit	Quantity	Unit Price	Amount
4" - 6" Pipe	LF	70	\$24.00	\$1,680.00
8" Pipe	LF		\$65.00	\$0.00
12" Pipe	LF		\$70.00	\$0.00
18" Pipe	LF		\$80.00	\$0.00
24" Pipe	LF		\$100.00	\$0.00
Extra Depth Excavation (Over 12' Deep)	FT*LF		\$6.00	\$0.00
Detention Vault	CF		\$10.00	\$0.00
Other Flow Control Facility	LS			\$0.00
Yard Drain	EA	2	\$265.00	\$530.00
Type 40 Catch Basin	EA		\$1,225.00	\$0.00
Curb Inlet	EA		\$1,500.00	\$0.00
Type I Catch Basin	EA		\$1,100.00	\$0.00
Type IL Catch Basin	EA		\$1,500.00	\$0.00
Type II Catch Basin - 48"	EA		\$3,300.00	\$0.00
Type II Catch Basin - 54"	EA		\$4,700.00	\$0.00
CMP Access to Riser	EA		\$1,600.00	\$0.00
Connection to Existing CB	EA		\$940.00	\$0.00
Restrictor/Pollution Control - 8"	EA		\$900.00	\$0.00
Restrictor/Pollution Control - 12"	EA		\$900.00	\$0.00
Pollution Control Tee	EA		\$500.00	\$0.00
Debris Barrier	EA		\$1,400.00	\$0.00
Biofiltration Swale	LF		\$15.00	\$0.00
Tightline Existing House Roof Drain	LF		\$15.00	\$0.00
				\$0.00
				\$0.00

Storm Drainage System - Total	\$2,210.00
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### Low Impact Development

Item	Unit	Quantity	Unit Price	Amount
Pervious Concrete	LF		\$108.00	\$0.00
Pervious Asphalt	LF		\$44.00	\$0.00
Pervious Pavers	SY	120	\$120.00	\$14,400.00
Infiltration Trench (10')	EA		\$300.00	\$0.00
Rain Garden	SY		\$120.00	\$0.00
Soil Amendment	SY		\$1.50	\$0.00
Drywell Infiltration	EA		\$500.00	\$0.00
				\$0.00
				\$0.00

Low Impact Development	\$14,400.00
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## Paving

Item	Unit	Quantity	Unit Price	Amount
4" Crushed Rock	SY	45	\$12.00	\$540.00
4" Asphalt Treated Base (ATB)	SY		\$21.00	\$0.00
2" Class B Asphalt Pavement	SY	45	\$19.00	\$855.00
				\$0.00
				\$0.00

Paving - Total	\$1,395.00
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## Miscellaneous

Item	Unit	Quantity	Unit Price	Amount
Property Corners	EA	6	\$300.00	\$1,800.00
Street Signs	EA		\$220.00	\$0.00
Fire Lane Marking	LF		\$2.00	\$0.00
UG Utilities to Existing House	EA		\$2,500.00	\$0.00
Modular Block Wall	SF		\$32.00	\$0.00
				\$0.00
				\$0.00

Miscellaneous - Total	\$1,800.00
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## Section 10 Operations and Maintenance

Individual owners will be responsible for their tight-lined roof and footing drains, permeable pavers, splash blocks, and private service drain systems located within their property limits. Symptoms of failure of this system are yard drains, clean-outs, or catch basins overtopping. If this happens, the homeowners should remove the yard drain lid or clean-out lid and remove visible debris. If the pump manhole experiences overtopping, the homeowner should evaluate and/or replace the pumps according to manufacturer recommendations. If problems still persist, the homeowner should have the service drain line cleaned.

Operation and Maintenance information from the City of Kirkland and 2009 KCSWDM included on the following pages is summarized as follows:

No. 5 – Catch Basins and Manholes (p. A-9)

No. 6 – Conveyance Pipes and Ditches (p. A-11)

No. 11 – Grounds (Landscaping) (p. A-16)

No. 24 – Catch Basin Insert (p. A-35)

COK Policy D-7 – General Maintenance Requirements for Permeable Pavement

COK Policy D-7 – General Maintenance Requirements for Basic Dispersion Systems

**NO. 5 – CATCH BASINS AND MANHOLES**

<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.
		Trash or debris in the catch basin that exceeds ⅓ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than ¼ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

<b>NO. 5 – CATCH BASINS AND MANHOLES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Condition When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Metal Grates (Catch Basins)	Unsafe grate opening	Grate with opening wider than $\frac{7}{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate. <b>Any open structure requires urgent maintenance.</b>	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. <b>Any open structure requires urgent maintenance.</b>	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

<b>NO. 6 – CONVEYANCE PIPES AND DITCHES</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Pipes	Sediment & debris accumulation	Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.	Water flows freely through pipes.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.
Ditches	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment accumulation	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion damage to slopes	Any erosion observed on a ditch slope.	Slopes are not eroding.
	Rock lining out of place or missing (If Applicable)	One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.	Replace rocks to design standards.

<b>NO. 11 – GROUNDS (LANDSCAPING)</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Site	Trash or litter	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Trees and Shrubs	Hazard	Any tree or limb of a tree identified as having a potential to fall and cause property damage or threaten human life. <b>A hazard tree identified by a qualified arborist must be removed as soon as possible.</b>	No hazard trees in facility.
	Damaged	Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Trees and shrubs with less than 5% of total foliage with split or broken limbs.
		Trees or shrubs that have been blown down or knocked over.	No blown down vegetation or knocked over vegetation. Trees or shrubs free of injury.
		Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Tree or shrub in place and adequately supported; dead or diseased trees removed.

<b>NO. 24 – CATCH BASIN INSERT</b>			
<b>Maintenance Component</b>	<b>Defect or Problem</b>	<b>Conditions When Maintenance is Needed</b>	<b>Results Expected When Maintenance is Performed</b>
Media Insert	Visible Oil	Visible oil sheen passing through media	Media inset replaced.
	Insert does not fit catch basin properly	Flow gets into catch basin without going through media.	All flow goes through media.
	Filter media plugged	Filter media plugged.	Flow through filter media is normal.
	Oil absorbent media saturated	Media oil saturated.	Oil absorbent media replaced.
	Water saturated	Catch basin insert is saturated with water, which no longer has the capacity to absorb.	Insert replaced.
	Service life exceeded	Regular interval replacement due to typical average life of media insert product, typically one month.	Media replaced at manufacturer's recommended interval.
	Seasonal maintenance	When storms occur and during the wet season.	Remove, clean and replace or install new insert after major storms, monthly during the wet season or at manufacturer's recommended interval.

## General Maintenance Requirements for Permeable Pavement

Maintenance Components	Required Inspection Frequency <sup>1</sup>	Condition When Maintenance is Required	Action Required
<b>Surface (address applicable components)</b>			
Permeable Asphalt or Concrete	Ongoing	Proactive measures.	Prohibit use of sand and sealant application and protect surface from adjacent runoff.
	A	Infiltration capacity of surface is restricted due to clogging.	Remove sediment and debris using brushes or sidewalk sweepers equipped with vacuums. After sediment removal, use an industrial pressure washer to restore permeability.
	A	Major cracks or trip hazards, and concrete spalling and raveling.	Fill with patching mixes. Large cracks and settlement may require cutting and replacing the pavement section.
Interlocking Concrete Paver Blocks	A	Infiltration capacity of surface is restricted due to clogging.	Remove sediment and debris using brushes or sidewalk sweepers equipped with vacuums.
	A	Paver block is missing or damaged.	Replace or repair damaged paver block.
	A	Settlement of surface.	May require resetting of blocks.
	A	Loss of void material between paver blocks.	Refill per manufacturer's recommendations.
Spill Response	As needed	Release of pollutants.	Clean up spills as soon as possible to prevent contamination of stormwater.

<sup>1</sup>Inspection Frequency: **A** = Annually; **B** = Biannually (twice per year); **S**= Additional inspections should be performed after major storm events. For debris/clog related maintenance, inspection should occur in the early fall, after deciduous trees have lost their leaves.

## General Maintenance Requirements for Basic Dispersion Systems

Maintenance Components	Required Inspection Frequency <sup>1</sup>	Condition When Maintenance is Required	Action Required
<b>Dispersion Trench</b>			
Dispersion trench	A	Visual evidence of water discharging at concentrated points along trench	Remove debris, realign notched grade board, or rebuild trench to standards
Surface of trench	Fall and Spring	Accumulated trash/debris or sediment on drain rock surface impedes sheet flow	Remove trash/debris, sediment
	A, W	Vegetation/moss present on drain rock surface impedes sheet flow from facility	Maintain open, freely draining drain rock surface
Pipe(s) to trench	A, W	Accumulation of trash/debris or sediment in roof drains, gutters, driveway drains, area drains, etc.	Remove trash/debris, sediment
	A, W	Pipe from sump to trench or drywell has accumulated sediment or is plugged	Clear sediment from inlet/outlet pipe screen and pipe
	A, W	Cracked, collapsed, broken, or misaligned drain pipes	Repair/seal cracks, or replace pipe
Sump	A	Sediment in sump	Remove sediment. Clear sediment from inlet/outlet pipe screen and pipe.
Access lid	A	Lid cannot be easily opened	Repair or replace lid
	A	Lid is buried	Expose and restore to surface grade
	A	Cover is missing	Replace cover
<b>Splash Block (Downspout Dispersion)</b>			
Splash block	B	Water is directed towards building structure	Reconfigure/repair blocks to direct water away from building structure
	B	Water disrupts soil media	Reconfigure/repair blocks
<b>Rock Pad (Concentrated Flow Dispersion)</b>			
Rock pad	A	Thin layer of rock above native soil in area 6 square feet or larger, or any exposure of native soil	Replace/repair rock pad to meet design standards. Enlarge pad size or add additional courses of rock.
	A	Soil erosion in or adjacent to rock pad	Eliminate cause of erosion, repair/replace rock
<b>Vegetated Dispersion Area (Sheet Flow Dispersion)</b>			
General dispersion area	B, S	Erosion (gullies/rills) greater than 2 inches deep	Eliminate cause of erosion and regrade, rock, and revegetate
	B, S	Accumulated sediment/debris blocks or channelizes flow path	Remove excess sediment or debris, identify and control sediment source
Ponded water	B, S	Standing surface water more than 3 days after storm event	Regrade to eliminate depressions or aerate/amend soils to increase infiltration
Plant establishment	Weekly (May-Sept)	Plant establishment period (2-3 years)	Water weekly during periods of no rain to ensure plant establishment
Vegetation	As needed	Poor vegetation such that erosion is occurring	Water, amend soils, replant with species for existing soil/moisture conditions
	B, S	Vegetation inhibits flow along flowpath	Trim, weed, or replant to restore dispersed flow path

<sup>1</sup>Inspection Frequency: **A** = Annually; **B** = Biannually (twice per year); **W** = At least once during the wet season; **S** = Additional inspections should be performed after major storm events. For debris/clog related maintenance, inspection should occur in the early fall, after deciduous trees have lost their leaves.